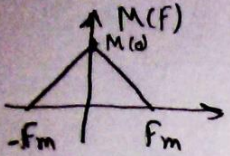
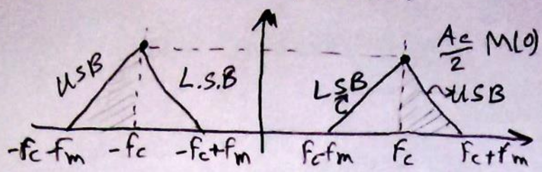
ملاحظات

SSB

Single Side Band:

DSBsc $\rightarrow s(t) = A_c\, m(t) \cos(2\pi f_c t)$



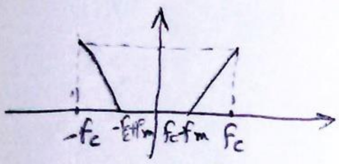


$B.W = F_m$ $\qquad$ $B.W = 2f_m$

SSB

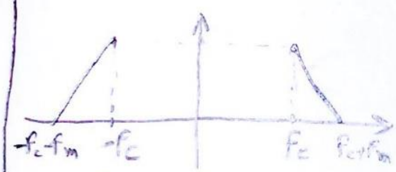
- We will transmit either USB or LSB Which decrease the required B.W. of DSBsc to half
- We will transmit the signal $m(t)$ by its original B.W.

LSB



$BW = f_m$

USB



$BW = f_m$

$m(t) \longrightarrow$ Message Signal

$\hat{m}(t) \longrightarrow$ Hilbert transform (Shift a signal 90°)

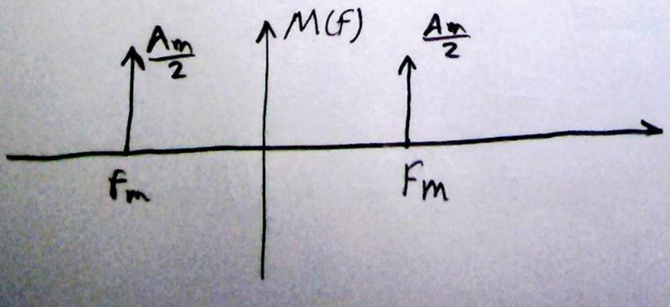
ex $\quad \sin t \rightleftharpoons \cos t$

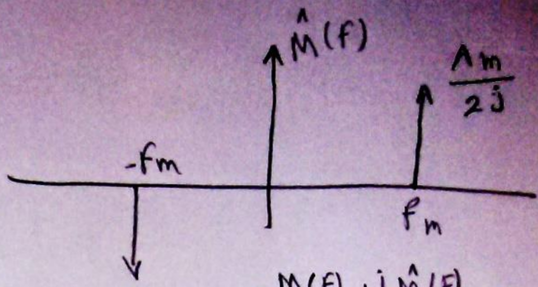
$m_+(t) = m(t) + j\,\hat{m}(t)$ يحتوي على تردد موجب فقط

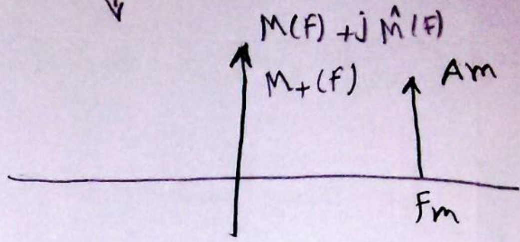
$m_-(t) = m(t) - j\,\hat{m}(t)$ يحتوي على تردد سالب فقط

$m(t) = A_m \cos(2\pi f_m t)$

$\hat{m}(t) = A_m \sin(2\pi f_m t)$







$$M_+(f) = \begin{cases} 2M(f) & f > 0 \\ 0 & f < 0 \end{cases}$$

$$M_-(f) = \begin{cases} 0 & f > 0 \\ 2M(f) & f < 0 \end{cases}$$

<u>USB</u>

$S(t) \Rightarrow M_+(f) \xrightarrow{\text{shift}} f_c$

$M_-(f) \xrightarrow{\text{shift}} -f_c$

$$S(t) = \frac{A_c}{4}\left[m_+(t)\, e^{+j2\pi f_c t} + m_-(t)\, e^{-j2\pi f_c t}\right]$$

$e^{j\theta} = \cos\theta + j\sin\theta$

نعوض عن $m_+(t)$, $m_-(t)$

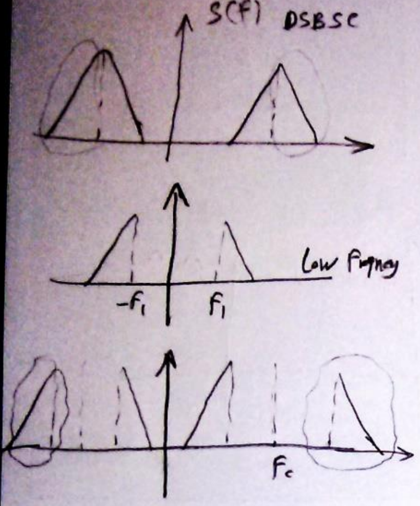
$$\underset{SSB}{S(t)} = \frac{A_c}{2}\left[m(t)\cos(2\pi f_c t) \pm \hat{m}(t)\sin(2\pi f_c t)\right]$$

LSB ← موجب

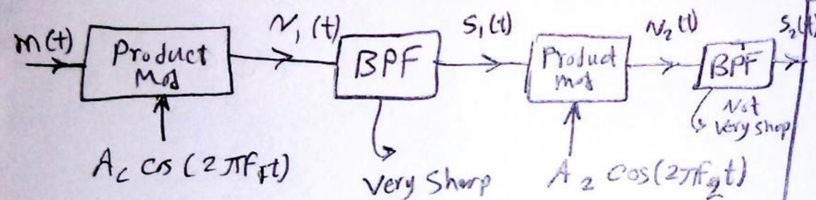
USB ← سالب

* Generation of SSB:

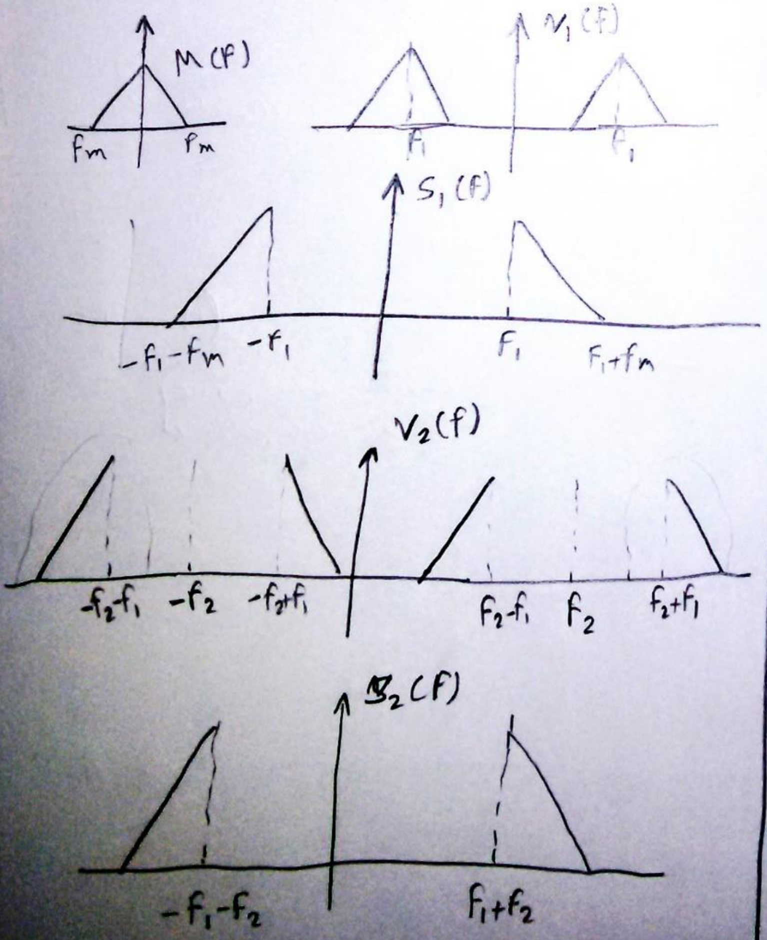
1 Frequency discrimination method



- لا يمكن استخدام Sharp filter لعملية الفصل بسبب الترددات العالية
- يتم التعديل على مرحلتين
أولاً filter عند تردد صغير
- ثم تعديل لنقل الإشارة لتردد عالي



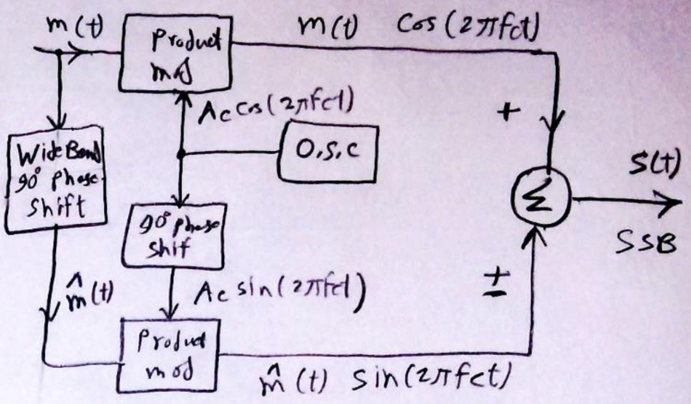
Product modulator is DSBSC mod



$\boxed{F_c = F_1 + f_c}$

2 Phase discriminator Method:

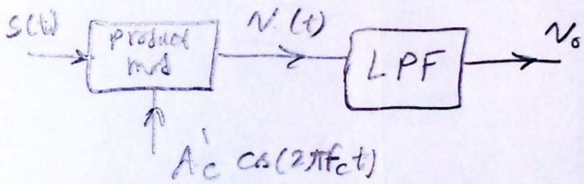
$$S(t) = \frac{A_c}{2}\left[m(t)\cos(2\pi f_c t) \pm \hat{m}(t)\sin(2\pi f_c t)\right]$$



* DeModulation of SSB:

1 Coherent detector

* Product Mod and LPF



$$v(t) = S(t)\, A_c' \cos(2\pi f_c t)$$

$$= A_c' \frac{A_c}{2} m(t)\cos(2\pi F_c t)\cos(2\pi f_c t)$$

$$\pm A_c' \frac{A_c}{2} \hat{m}(t)\sin(2\pi f_c t)\cos(2\pi f_c t)$$

$$= \frac{A_c A_c'}{4}\left[1 + \cos(4\pi f_c t)\right] m(t)$$

$$\pm \frac{A_c A_c'}{4}\left[\underbrace{\sin(0)}_{\to 0} + \sin(4\pi f_c t)\right]\hat{m}(t)$$

$$= \frac{A_c A_c'}{4}\left[m(t) + m(t)\cos(4\pi f_c t)\right]$$

$$\pm \frac{A_c A_c'}{4} \hat{m}(t)\sin(4\pi f_c t)$$

after LPF

$$v_o(t) = \frac{A_c A_c'}{4} m(t)$$